



A New *Calotes* (Squamata: Agamidae) from the Indo-Burman Range of Western Myanmar (Burma)

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A new species of *Calotes* is described from the Indo-Burman Range, western Myanmar. It was found between elevations of 737 m to 1940 m in areas of shifting cultivation and secondary forest. It differs from other species of *Calotes* from Myanmar by a combination of its large size, SVL up to 142.9 mm, relatively small body scales, 59–74 midbody scale rows, the tail in adult males being swollen posterior to base and the presence of head spines. The new species increases the diversity of *Calotes* species in Myanmar to six. A key to the *Calotes* of Myanmar is provided.

The genus *Calotes* Cuvier, 1817 currently contains 20 species (Hallermann 2000), distributed from eastern Iran east to Sumatra, Indonesia (Welch 1994; Manthey and Grossmann 1997) including two isolated species, one in Sabah, Malaysia (*C. kinabaluensis* de Grijis, 1937) and the other on Ambon Island, Moluccas Islands, Indonesia (*C. nigriplicatus* Hallermann, 2000). Five species are known to occur within Myanmar: *Calotes emma*, *C. jerdoni*, *C. kingdonwardi*, *C. mystaceus* and *C. versicolor* (Smith 1935; Welch 1994). *Calotes mystaceus* and *C. versicolor* are widespread. *Calotes emma* although it may occur throughout much of Myanmar, to date the Myanmar Herpetological Survey team has not found it west of the Ayeyarwady River. However, it is known to occur in Bangladesh (CAS 94323) and northeastern India (Smith 1935; Pawar and Birand 2001). *Calotes jerdoni* is known from the Chin Hills of the Indo-Burman Range and along the southern flanks of the eastern Himalayas. *Calotes kingdonwardi* is restricted to the eastern Himalayas (Smith 1935).

MATERIALS AND METHODS

All specimens were hand collected, euthanized, fixed in 10% buffered formalin and later transferred to 70% ethanol. Latitude, longitude and elevation were recorded using a Garmin 12 GPS receiver (datum WGS 84). Museum symbolic codes follow Leviton et al. (1985).

Data for the following meristic characters and measurements were recorded for adult specimens: supralabials (SupL), number of enlarged scales bordering left and right margin of upper lip (not including rostral scale); infralabials (InfL), number of enlarged scales bordering left and right margin of lower lip (not including mental scale); number of scales around midbody (MidB); number of nuchal and dorsal crest spines (DC), enlarged mid-dorsal crest scales from posterior portion of the head to just above anterior margin of vent; number of subdigital lamellae on the right fourth toe (SDL 4th toe), including the last scale on claw base, snout-vent length (SVL); tail length (TailL);

head length (HeadL), distance from tip of snout to rear border of right angle of jaw; head width (HeadW), widest point in the temporal region, anterior to the tympanum; length of third and fourth toes on right foot (3rd Toe and 4th Toe, respectively); width of tail at widest point of swelling in males and the homologous area in females (TailD) and ratios of TailL/SVL, HeadW/HeadL, HeadL/SVL, HeadW/SVL.

Scale counts and observations of external morphology were made using a dissecting microscope. Measurements, except for TailL, were taken with digital calipers and rounded to the nearest 0.1 mm, TailL were measured using a measuring tape with a precision of 1 mm.

Measurements and meristic characters for males and females were compared using the two-tailed independent samples Student's *t*-test. SPSS (version 10.0 for Macintosh) was used for all statistical analysis.

SPECIES DESCRIPTION

Calotes chincollium Vindum, sp. nov.

Figs. 1–5

?*Calotes emma*, Shreve 1940, Proc. New England Zool. Club 18:24.

DIAGNOSIS AND COMPARISONS.— A species of *Calotes* morphologically similar to *C. mystaceus*, head and body robust, slightly compressed dorso-ventrally, snout-vent length to 142.9 mm; body scales relatively small, homogeneous, feebly keeled, arranged in regular rows, upper dorso-lateral scales pointing backwards and upwards and lower flank scales pointing backwards, 59–74 midbody scale rows; dorsal and dorso-lateral scales nearly equal in size to ventrals. Head shape triangular, forehead concave; one enlarged temporal spine on either side of the upper head between the occiput, orbit and tympanum. Nine to 12 supralabial scales and eight to 11 infralabials. Gular scales feebly keeled, males with large gular pouch and cheek pouches. Nuchal crest composed of erect compressed scales, partly overlapping, lanceolate, slightly falcate, directed posteriorly; dorsal crest follows the nuchal crest without a gap, 42–54 nuchal and dorsal crest spines. Distinct oblique fold of skin covered with small granular dark brown scales in front of shoulder. Limbs moderate, fourth toe longer than third, fourth right toe with 23–28 subdigital lamellae. Tail in adult males swollen posterior to base.

Calotes chincollium can be differentiated from all other *Calotes* by a combination of the following characters: its large size at maturity, relatively small body scales, the presence of an oblique fold in front of shoulder, the presence of head spines and the males having a swollen tail posterior to base. *C. chincollium* differs from other Myanmar and northeast India congeners as follows: from the males of all other species, except *C. kingdonwardi*, by males having a swollen tail base; from *C. maria* and *C. jerdoni* by lacking two parallel rows of compressed scales above tympanum and by its larger size (SVL to 120 mm in *C. maria* [Smith 1935]) and to 100 mm in *C. jerdoni* (adult C♂ specimens); from *C. mystaceus* by the larger number of midbody scale rows (*C. mystaceus* having 47–57 [CAS specimens]; 48–56 [Hallermann 2000]) and by the gradual reduction in size of the crest scales from the nuchal crest scales to the dorsal crest scales (crest scales in *C. mystaceus* are short in the nape area, between the nuchal and dorsal crests); from *C. versicolor* by having an oblique fold in front of shoulder (absent in *C. versicolor*) and larger number of midbody scale rows (*C. versicolor* has 40–50 [Smith 1935]); from *C. emma* by lacking postorbital spines and by having small supraocular scales (*C. emma* has large rectangular supraoculars); and from *C. kingdonwardi* by having more midbody scale rows (45 in *C. kingdonwardi* [Smith 1935] and KIZ specimens), and having scales on the side of the body pointing upwards and backwards and the lower

flank scales pointing backwards (scales in *C. kingdonwardi* pointing backwards and downwards except for upper two to three rows, which point slightly upwards (Smith 1935) or straight backwards [KIZ specimens]) and the presence of head spines and a dorsal crest which are lacking and greatly reduced, respectively, in *C. kingdonwardi* (Smith 1935 and KIZ specimens).

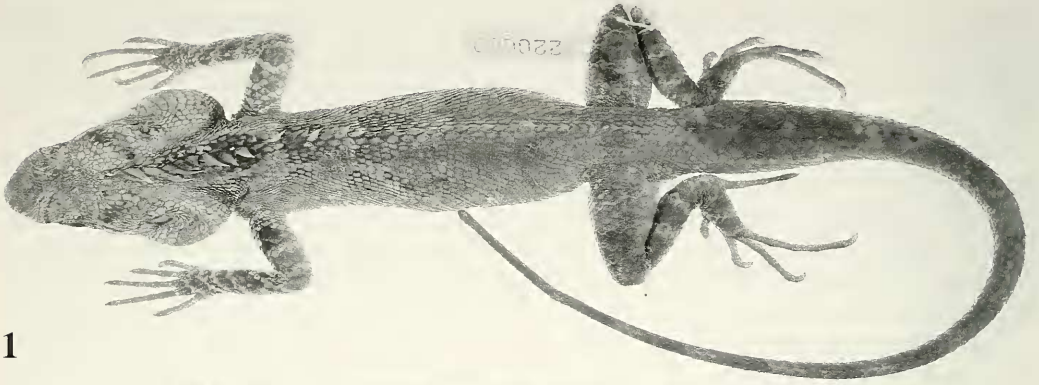
HOLOTYPE.— CAS 220009 (Figs. 1–3), adult ♂, from 21°23'11.2" N, 93°58'15.9" E, 1174 m elevation, Min Dat Township, Min Dat District, Chin State, Myanmar, collected 20 March 2002 by Htun Win, Kyi Soe Lwin and Awan Khwi Shein.

DESCRIPTION OF HOLOTYPE.— Adult ♂ with a SVL of 142.9 mm; TailL 253 mm (incomplete tail); HeadL 48.6 mm; HeadW 30.6 mm; and 68 scales around midbody and 46 nuchal and dorsal crest scales.

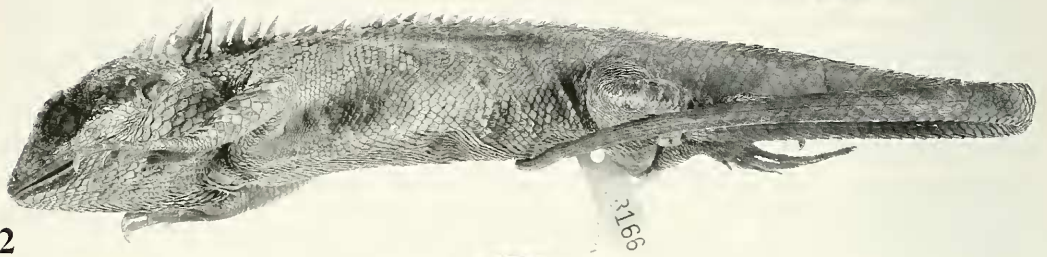
Canthus rostralis sharp and straight; upper head scales unequal, smooth; rostral scale low, same height as touching supralabials, about twice as wide as high, bordered behind by two supralabials and four postrostrals; ten supralabials on both sides; a series of four scales run along the midline posterior to the postrostrals, the third and fourth largest and slightly elevated; posterior to the fourth scale, are two scales on either side directed diagonally towards the orbit; the posterior six scales form a weak inverted 'Y'-shaped pattern; the inner border of the supraocular region with a semicircular series of enlarged, feebly keeled scales; at closest point three head scales separate the left and right series; scales within the semicircular series smaller and feebly keeled; a minute tubercle at posterior end of supraciliary ridge; one enlarged spine on either side of the upper head between the occiput, orbit and tympanum; tympanum exposed, 6.8 mm horizontal diameter, about 2/3 the size of the orbit (10.6 mm horizontal diameter); a transverse series of four enlarged scales form an elevated ridge between the posterior margin of the orbit and the anterior margin of the tympanum, middle two scales being the largest and posterior scale most strongly keeled; a transverse series of four scales above the tympanum, anterior scale keeled, second and fourth pointed and the third is an enlarged spine.

Mental triangular becoming narrow posteriorly, as wide as long, slightly wider than rostral; mental followed by an infralabial on either side and two irregular shaped postmentals; postmentals higher than long, in contact with the first infralabials and the length of the mental except for the posterior tip of the mental where the postmentals are separated by two small scales medially; posterior to the postmentals are two chin shields on each side that are longer than wide and parallel to the infralabials, separated from the infralabials by one scale row. The first and second chin shields are scarcely larger than the chin shields following; ten infralabials on both sides; large gular pouch, gular scales strongly imbricate; lateral gular scales form a gradation from almost rounded scales, each weakly mucronate, most smooth or with a slight rise medially to more lanceolate and mucronate medial scales, outer scales wider than long, medial scales longer than wide; lateral gular scales pointing posteriorly and medially, medial scales pointing straight back; most lateral gular scales with one hair receptor at tip or in notch next to tip; cheek pouches large, extending beyond the plane of the temporal region (horizontally from the base of the tympanum) by 6.1 mm, and beyond the tympanum by 9.5 mm on either side.

Large oblique curved fold in front of shoulder, covered with small granular scales; seven scale rows separate the dorsal border of fold from the base of upright scale series adjacent to the nuchal crest; nuchal crest composed of erect compressed scales, partly overlapping, lanceolate, slightly falcate, directed posteriorly, with the 7th to 10th scales being the largest, and a continuous reduction in size anteriorly and posteriorly; dorsal crest follows the nuchal crest without a gap, the gradation of decreasing scale length is continuous posteriorly and does not change from nuchal crest scales to dorsal crest scales; longest nuchal scale extends 15.3 mm from the base of the scale bordering the crest scale; dorsal crest scales do not overlap and become more triangular and gradually lower



1



2



3

FIGURES 1–3. (1) Dorsal view of the holotype of *Calotes chincollium*, sp. nov. (CAS 220009), male. SVL 142.9 mm, from 21°23'11.2" N, 93°58'15.9" E; 1174 m elevation, Min Dat Township, Min Dat District, Chin State, Myanmar; (2) Lateral view of the holotype of *Calotes chincollium*, sp. nov.; (3) Ventral view of anterior portion of the holotype of *Calotes chincollium*, sp. nov. Photographs by Dong Lin, California Academy of Sciences.

posteriorly; 46 mid-dorsal crest scales from the occiput to above the anterior margin of the vent; scales are reduced to a low crest over the sacrum, forming a keeled ridge along the anterior portion of the tail. The nuchal and dorsal crests are bordered on either side by a row of lower erect (pointing dorsally and posteriorly), keeled, mucronate, scales, becoming smaller posteriorly, ending at the sacrum; dorsal and lateral body scales feebly keeled, imbricate, dorsal scales being slightly larger, pointing slightly dorso-posteriorly, lower scales on flanks pointing backwards; dorsal and lateral scales equal in size with ventral scales, the slightly larger dorsal-most scales on sides are about equal to the ventral scales in the chest area, and the lower lateral scales are equal to ventral scales on the abdomen; ventral scales keeled, imbricate, weakly mucronate, pointing posteriorly, 20–22 rows; left hemipenis partially everted.

Forelimbs covered with imbricate, feebly keeled scales, some slightly mucronate; third and fourth, second and fifth, fingers equal in length, first finger smallest; scales under fingers bicarinate, right fourth finger with 23 lamellae (including last scale on claw base); dorsal surface of thigh and dorsal and ventral surfaces of lower leg with imbricate, feebly keeled scales, some slightly mucronate; ventral surface of thigh with smooth rectangular, slightly imbricate scales; scales on posterior portion of thigh imbricate, keeled and mucronate; fourth toe longest (about 1/3 longer than third) followed by third, fifth, second and first; scales under toes bicarinate, right fourth toe with 25 lamellae (including last scale on claw base).

Tail slightly oval in cross-section, swollen posterior to base, with large, strongly keeled, mucronate, scales, arranged in longitudinal rows; tail tip autonomized. Scales of tail larger than dorsal or ventral body scales.

COLORATION IN ALCOHOL.— Upper head grayish, darker on snout; supraciliaries with two parallel light brown bars perpendicular to head axis; irregular brown patch from anterior border of orbit to dorso-anterior border of tympanum, extending dorsally to the supraciliary ridge, slightly bifurcating posteriorly, lower branch ending at the tympanum and the upper extending to the nuchal crest at occiput. Light gray on upper lip extending dorsally to orbit and lower temporal area (below dorsal borders of tympanum), tympanum and cheek pouches. Body grayish with four brownish irregular saddles extending across the back. Anterior-most saddle weak, directly behind occiput, most scales gray with brown at base; second and third saddles brown from base of dorsal crest scales to fourth scale row below dorsal crest (counting crest scale as first). Fourth saddle extends down six scale rows, dorsal portion of saddles the widest, each saddle separated by one or two scales. Tail uniform light olive-brown with dark and light barring toward the tip, darker bars about four transverse scale rows wide, lighter bars two to three scale rows. Dorsal surface of forelimbs grayish with irregular brown bars, gray bars one scale row wide, brown bars two scale rows wide; barring extends on to foot (barring is more prominent on left forelimb). Upper surface of thigh grayish at base with increasing brown proximally, lower leg and foot with gray and brown barring, with brown bars being wider. Gular pinkish from scales posterior to mental and postmentals and extending to ventral portion of cheeks. Inner scales of oblique fold in front of shoulder black. Venter and ventral surface of limbs gray. Ventral side of tail light brownish-gray.

VARIATION.— Body measurements and meristic characters are shown in Tables 1 and 2, respectively, for specimens with a SVL more than 96 mm.

Specimens ranged in size from the smallest juvenile with a SVL of 33.8 mm (CAS 222349) to the largest male SVL 142.9 mm (CAS 220009); and the largest female SVL 123.5 mm (CAS 220120).

Adult males are significantly larger than adult females, having longer snout-vent lengths, tail lengths, head lengths, head widths, and fewer dorsal crest scales (Table 3). The heads of adult males are absolutely and proportionally longer and wider than females of the same snout-vent

TABLE 1. Sex and measurements (in mm) for *Calotes chincollium*
 (- indicates incomplete tail and * indicates measurements from left foot)

Catalog Number	SEX	SVL	TailL	TailL/ SVL	HeadL	HeadW	HeadW/ HeadL	HeadL/ SVL	HeadW/ SVL	3rd Toe	4th Toe	TailD
CAS 219972	M	133.3	247	1.85	44.6	27.5	0.617	0.335	0.206	14.3	18.7	17.3
CAS 219973	M	114.3	235	2.06	37.7	22.5	0.597	0.330	0.197	14.0	19.6	13.8
CAS 219974	M	119.0	198-		38.2	22.8	0.596	0.321	0.192	13.4	20.1	15.0
CAS 219976	M	134.7	271	2.01	47.4	28.6	0.603	0.352	0.212	14.0*	21.6*	18.9
CAS 219977	M	120.2	242	2.01	41.2	25.8	0.626	0.343	0.215	14.3	18.5	17.5
CAS 219978	M	112.0	235	2.10	37.5	21.0	0.560	0.335	0.188	14.3	19.6	13.8
CAS 219990	M	117.5	238	2.03	41.0	25.0	0.610	0.349	0.213	13.8	20.7	16.3
CAS 219996	M	120.2	267	2.22	40.3	25.6	0.635	0.335	0.213	13.6	20.5	16.1
CAS 219997	M	101.6	214	2.11	33.6	21.0	0.625	0.331	0.207	14.2	19.2	13.7
CAS 220009	M	142.9	253-		48.6	30.6	0.630	0.340	0.214	17.0	25.0	19.2
CAS 220012	M	134.1	269	2.01	45.4	28.3	0.623	0.339	0.211	13.5*	19.8*	17.5
CAS 220027	M	127.2	269	2.11	44.3	26.3	0.594	0.348	0.207	15.3	22.2	17.3
CAS 220028	M	101.3	201-		33.0	19.7	0.597	0.356	0.194	14.3	19.8	13.3
CAS 220029	M	120.5	288	2.39	44.1	27.2	0.617	0.366	0.226	14.9	22.2	17.5
CAS 220034	M	100.1	211	2.11	33.1	19.9	0.601	0.331	0.199	12.8	17.6	12.5
CAS 220035	M	115.5	238	2.06	38.5	22.9	0.595	0.333	0.198	13.2	17.8	16.3
CAS 220039	M	136.3	293	2.15	49.4	28.8	0.583	0.362	0.211	16.9	23.0	19.8
CAS 220046	M	130.8	281	2.15	42.7	26.3	0.616	0.326	0.201	16.7	24.0	17.2
CAS 220049	M	139.2	306	2.20	49.0	29.4	0.600	0.352	0.211	16.4	22.8	18.1
CAS 220117	M	132.6	287	2.16	48.5	29.8	0.614	0.366	0.225	15.7	21.5	18.8
CAS 220121	M	130.2	290	2.23	46.6	29.6	0.635	0.358	0.227	16.3	23.0	20.1
CAS 220125	M	137.9	297	2.15	45.9	29.8	0.649	0.333	0.216	14.6	20.1	18.2
CAS 220577	M	114.2	265	2.32	37.7	22.2	0.589	0.330	0.194	16.7	19.7	13.7
CAS 220580	M	131.3	266	2.03	46.5	30.8	0.662	0.354	0.235	14.5	19.9	18.6
CAS 220581	M	108.2	244	2.26	37.4	21.4	0.572	0.346	0.198	14.7	20.6	14.1
CAS 220582	M	118.5	248	2.09	38.5	23.7	0.616	0.325	0.2	13.6	18.7	15.0
CAS 220583	M	125.5	265	2.11	44.5	27.4	0.616	0.355	0.218	15.6	22.3	17.9
CAS 222354	M	104.0	216	2.08	34.9	20.7	0.593	0.336	0.199	13.3	17.9	13.6
CAS 222370	M	126.4	261	2.06	43.3	26.6	0.614	0.343	0.21	16.2	21.7	15.4
MCZ 44727	M	113.4	252	2.22	38.9	22.7	0.584	0.343	0.2	15.0	20.6	14.7
MCZ 44728	M	114.7	255	2.22	40.6	22.2	0.547	0.354	0.194	14.7	21.7	14.8
MCZ 44729	M	104.2	222	2.13	35.5	21.3	0.600	0.341	0.204	14.8	18.5	15.4
USNM 547926	M	117.6	232	1.97	40.4	24.3	0.601	0.344	0.207	16.0	21.2	15.4
USNM 547927	M	137.1	299	2.18	49.5	30.8	0.622	0.361	0.225	16.7	24.3	19.8
CAS 219971	F	96.8	206	2.13	30.8	19.0	0.617	0.318	0.196	12.5	16.8	8.8
CAS 219975	F	119.5	234	1.96	35.9	22.2	0.618	0.300	0.186	13.5	18.6	11.9
CAS 220014	F	113.7	251	2.21	36.1	22.0	0.609	0.318	0.193	15.2	20.4	11.6
CAS 220022	F	117.8	220	1.87	35.6	21.6	0.607	0.302	0.183	16.9	24.1	11.0
CAS 220120	F	123.5	251	2.03	38.9	20.9	0.537	0.315	0.169	14.3	19.9	11.0
CAS 220578	F	97.7	204	2.09	30.8	18.4	0.547	0.315	0.188	13.1	18.5	9.6
CAS 220579	F	99.4	224	2.25	32.5	18.7	0.597	0.327	0.188	13.2	19.0	9.9
CAS 220584	F	114.7	229	2.00	38.6	22.0	0.570	0.337	0.192	14.0	21.9	11.8
CAS 220587	F	108.2	221	2.04	34.1	20.0	0.587	0.315	0.185	14.2	18.2	11.0
CAS 222351	F	101.7	230	2.26	32.9	20.2	0.614	0.324	0.199	13.3	19.7	11.2

TABLE 2. Meristic characters for *Calotes chincollium*
(* indicates scale counts from left foot)

<i>Catalog Number</i>	<i>SEX</i>	<i>Mid B</i>	<i>DC</i>	<i>SupL (L/R)</i>	<i>InfL (L/R)</i>	<i>SDL 4th Toe</i>
CAS 219972	M	68	47	11/11	10/10	25
CAS 219973	M	63	46	11/10	10/11	26
CAS 219974	M	59	45	12/11	10/10	25
CAS 219976	M	61	45	9/9	8/11	26*
CAS 219977	M	70	45	11/10	9/9	23
CAS 219978	M	65	45	10/11	9/9	23
CAS 219990	M	65	46	11/10	9/9	26
CAS 219996	M	66	45	11/10	10/9	26
CAS 219997	M	61	44	10/10	9/9	25
CAS 220009	M	68	46	10/10	10/10	25
CAS 220012	M	67	48	10/9	10/10	25
CAS 220027	M	69	45	9/10	10/10	25
CAS 220028	M	63	46	11/10	10/10	27
CAS 220029	M	74	54	12/11	11/11	26
CAS 220034	M	62	45	10/11	9/10	23
CAS 220035	M	66	45	11/10	9/9	26
CAS 220039	M	68	45	11/11	11/9	25
CAS 220046	M	71	45	11/10	10/10	27
CAS 220049	M	69	42	10/10	10/10	26
CAS 220117	M	70	45	10/10	10/11	26
CAS 220121	M	69	45	9/10	9/10	26
CAS 220125	M	67	45	9/11	9/10	25
CAS 220577	M	62	42	11/11	10/10	25
CAS 220580	M	66	48	10/9	10/9	25
CAS 220581	M	62	44	10/9	9/10	27
CAS 220582	M	69	47	10/10	10/11	25
CAS 220583	M	68	46	10/10	9/10	25
CAS 222354	M	70	46	11/11	11/11	26
CAS 222370	M	68	46	10/11	10/9	24
MCZ 44727	M	68	44	10/10	9/9	26
MCZ 44728	M	71	46	10/10	9/10	25
MCZ 44729	M	65	49	9/9	9/9	26
USNM 547926	M	70	47	10/11	11/9	25
USNM 547927	M	67	45	11/10	10/11	28
CAS 219971	F	65	45	11/11	10/10	24
CAS 219975	F	67	47	10/11	9/9	25
CAS 220014	F	68	47	10/11	9/9	26
CAS 220022	F	65	47	9/9	9/9	28
CAS 220120	F	70	48	10/10	10/10	23
CAS 220578	F	66	50	10/10	9/9	28
CAS 220579	F	70	47	11/11	10/10	26
CAS 220584	F	71	49	10/11	8/10	24
CAS 220587	F	65	46	10/10	11/10	23
CAS 222351	F	70	49	10/10	9/9	23

length. Additional sexual characteristics include males having a swollen tail posterior to its base (Table 3) and larger cheek pouches. The dorsal coloration differs between the sexes with the dark saddles in males being lighter or completely faded posteriorly.

COLOR IN LIFE (Fig. 4; based on color transparency of CAS 222354 [σ]): Upper head gray, side of head with distinct dark brown mask from loreal area through orbit and temporal region;

TABLE 3. Body measurements (mm) and meristic characters for male and female *Calotes chincollium* ($X \pm SD$, followed by ranges in parentheses, $N=34$ for males (except for TailL where $N=31$) and $N=10$ for females). Statistically significant results at $0.05 \geq P > 0.01$ are marked with one asterick (*), results at $0.01 \geq P > 0.001$ are marked with two astericks (**) and results at $P \leq 0.001$ are marked with three astericks (***)

	<i>Males</i>	<i>Females</i>
SVL**	121.7 \pm 12.1 (100.1–142.9)	109.3 \pm 9.9 (96.8–123.5)
TailL***	258.2 \pm 26.6 (211–306)	227.0 \pm 15.9 (204–251)
HeadL***	41.7 \pm 5.0 (33.0–49.5)	34.6 \pm 2.9 (30.8–38.9)
HeadW***	25.4 \pm 3.5 (19.7–30.8)	20.5 \pm 1.5 (18.4–22.2)
3rd Toe	14.9 \pm 1.2 (12.8–17.0)	14.0 \pm 1.3 (12.5–16.9)
4th Toe	20.7 \pm 1.9 (17.6–25.0)	19.7 \pm 2.1 (16.8–24.1)
TailD***	16.4 \pm 2.2 (12.5–20.1)	10.8 \pm 1.0 (8.8–11.9)
MidB	66.7 \pm 3.5 (59–74)	67.7 \pm 2.4 (65–71)
DC*	45.7 \pm 2.1 (42–54)	47.5 \pm 1.5 (45–50)
SDL 4th Toe	25.4 \pm 1.1 (23–28)	25.0 \pm 1.9 (23–28)
TailL/SVL	2.12 \pm 0.108 (1.85–2.39)	2.08 \pm 0.129 (1.87–2.26)
HeadL/SVL***	0.343 \pm 0.0122 (0.321–0.366)	0.317 \pm 0.0109 (0.300–0.337)
HeadW/SVL***	0.208 \pm 0.0114 (0.188–0.235)	0.188 \pm 0.00833 (0.169–0.199)

white along the upper lip to the orbit and upper margin of the tympanum and along lower jaw extending onto cheek pouch; nuchal crest bright yellow; gular orange; anterior half of body creamy yellow with flanks spotted with darker yellow, first two dorsal saddles brown; posterior portion of body with light brown and gray mottling; forelimbs banded dark brown and white.

COLORATION IN ALCOHOL (Fig. 5; based on CAS 220022 [σ]): Upper head speckled tan, gray and cream; supraciliaries with two parallel brown bars perpendicular to head; brown patch from anterior border of orbit to dorso-anterior border of tympanum extending dorsally to spines above tympanum; lighter brown (but darker than upper head coloration) between spines over tympanum and occiput spines extending from the posterior supraciliary ridge to the back of the head. Light gray on upper lip extending dorsally to orbit and extending to the lower temporal area including the tympanum. Dorsal coloration cream becoming gray on flanks. Brown triangular patch extending along the anterior margin of the fold in front of the shoulder to the posterior side of the angle of the jaw, extending horizontally between the back of the head (at the level of the upper margin of the tympanum) back to the shoulder fold. From nape to area dorsal to the anterior margin of the vent are seven dark brown irregular bands or saddles, with the coloration extending onto the nuchal and dorsal crest scales. The first four saddles are the most distinct. The anterior most saddle on the nape extends from the nuchal crest onto the back of the head, forming a V-shaped pattern; posterior to the nape the bands are widest along the dorsal crest becoming constricted on the lower portion of the dorsum and then becoming less distinct, irregular and bifurcated on the flank. The sec-



FIGURE 4. Paratype of *Calotes chincolium*, sp. nov. (CAS 222354) a male, SVL 104.0 mm, from 21°11'53.3" N, 94°04'00.5" E, Kanpetlet Township, Min Dat District, Chin State, Myanmar. Photograph by Hla Tun, Forest Department, Ministry of Forestry, Myanmar.

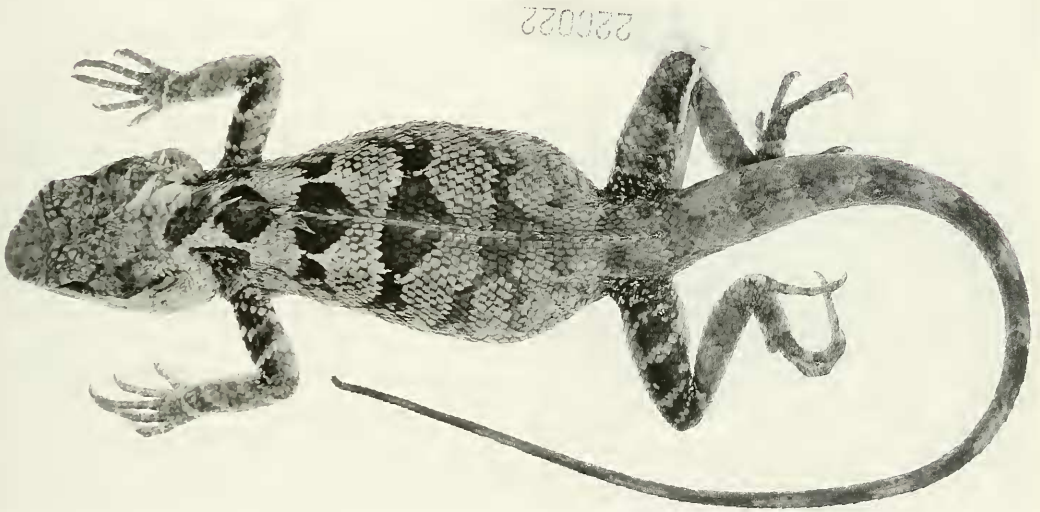


FIGURE 5. Paratype of *Calotes chincolium*, sp. nov. (CAS 220022) a female, SVL 117.8 mm, from 21°22'11.5" N, 93°46'01.7" E, 1,732 m elevation, Min Dat Township, Min Dat District, Chin State, Myanmar. Photograph by Dong Lin, California Academy of Sciences.

ond and third are separated from the brown flank pattern by one scale row giving a faint hint of a lateral stripe. When viewed from above the dorsal bands appear triangular in shape, with the tip of the triangle pointing backwards. The tail is banded throughout with light and dark brown banding, the darker bands being wider. Forelimbs and hindlimbs barred like in holotype. Gular scales pinkish on anterior two-thirds and along the sides; medial posterior third with scales having small dark gray spotting giving an overall grayish appearance. Venter including upper forearms and legs with light gray and dark gray mottling, more so on abdomen. Lower arms and legs with uniform light gray. Underside of tail light and dark gray banding corresponding to the dorsal bands.

CAS 219975, ♀, SVL 119.5 mm, tail length 234 mm, is similar in pattern to CAS 220022 but darker and mottled throughout. Only nape and following two saddles distinct.

COLORATION IN ALCOHOL OF SMALLEST JUVENILE (CAS 222349, SVL 33.8 mm): Upper head gray-brown; supraciliaries with two faint parallel brown bars perpendicular to head; orbit with nine dark brown stripes radiating outwards from eye; brown patch from anterior border of orbit to dorso-anterior border of tympanum extending dorsally to spines above tympanum; lighter brown (but darker than upper head coloration) between spines over tympanum and occiput spines extending from the posterior supraciliary ridge to the back of the head. Light gray on upper lip extending dorsally to orbit and extending to the lower temporal area including tympanum. Dorsal coloration gray. Faint dark brown horizontal stripe extending from the dorsal margin of the fold in front of the shoulder to the back of the head. From nape to area dorsal to the anterior margin of the vent are five brown irregular saddles. The anterior most saddle on the nape extends from the nuchal crest laterally two scale rows. When viewed from above the dorsal bands appear triangular in shape, with the tip of the triangle pointing backwards. The tail is banded throughout with light and brown banding, the lighter bands being wider. Forelimbs and hindlimbs bared. Venter including upper forearms and legs light gray. Lower arms and legs uniform light gray.



FIGURE 6. Map of western Myanmar illustrating the distribution of *Calotes chincollium*. Map prepared by Michelle S. Koo, California Academy of Sciences.

ETYMOLOGY.— The specific epithet refers to the type locality being in the Chin Hills; *chincollium* is a combination of the Anglicized version of a Burmese inscription word for the Chin people and *collium*, Latin in the genitive plural of *collis*, meaning hill.

DISTRIBUTION AND NATURAL HISTORY.— *Calotes chincollium* is known from the Chin Hills, Chin State, and from the Ponnyadaung Range, Sagaing Division, Myanmar (Fig. 6), between elevations of 737 m to 1940 m. The species is most common in areas of shifting cultivation and extends into secondary forest. The species is not found in primary forest. It is primarily found on the ground but climbs onto the base of trees. Htun Win and Awan Khwi Shein observed individuals in recently planted corn fields digging up newly sprouting corn and eating the endosperm tissue of the seedlings.

The holotype was found in sympatry with *Calotes jerdoni*, *C. mystaceus* and *C. versicolor*. Other agamids in the vicinity of *Calotes chincollium* include *Ptyctolaemus gularis*, *Draco maculatus* and *Japalura planidorsata*.

DISCUSSION

The new species superficially resembles the description given by Taylor (1963) for *Calotes emma alticristatus* Schmidt 1925, except that *C. emma alticristatus* has enlarged, elongate scales in the supraocular region; two enlarged chin shields behind each of the postmentals; five postrostral scales; a grayish chin and gular area with black interstitial skin; and tail base is not swollen (Taylor did not give the sex of his specimen, and we have not been able to locate it).

The type locality of *C. emma alticristatus* is “Yunnanfu, Yunnan” (Schmidt 1925), and Taylor

(1963) reported the distribution extending into Chiang Mai Province, Thailand. However, Wermuth (1967), Welch (1994) and Cox et al. (1998) list the distribution of *C. emma alticristatus* as extending northwest into Assam, India. We have found no evidence (either specimens or records in the literature) of *C. emma alticristatus* occurring west of Thailand (namely in Burma, India or Bangladesh). Specimens of *C. emma* from Mon State (CAS 222213), Shan State (CAS 215260) and Mandalay Division (CAS 216395), Myanmar, and Bangladesh (CAS 94323) all have enlarged postorbital spines characteristic of *C. emma emma*.

Recent collections from the lowlands surrounding and the mountains of the Indo-Burman Range, specifically the Rakhine Yoma and Chin Hills have yielded a number of new species: *Lycodon zawi* (Slowinski et al. 2001) from the Rakhine Yoma, Rakhine State, Ponnyadaung Range, Sagaing Division, and the Khasi Hills, India; *Calotes chincolium* from the Chin Hills and the Ponnyadaung Range; *Bufo* sp. (Wogan et al. 2003) and *Chirixalus* sp. (Wilkinson et al. 2003) from the western lowlands of the Rakhine Yoma; and at least three additional new frog species yet to be described from the Rakhine Yoma (pers. commun. G.O.U. Wogan 2002). All new species seem to be endemic to the Indo-Burman Range or limited to the Rakhine Yoma or Chin Hills within the Indo-Burman Range, with the exception of *Lycodon zawi*, which extends into the Khasi Hills, India.

The occurrence of new species being discovered in the Indo-Burman Range is not surprising considering the geological history of the area and the paucity of collections. The Indo-Burman Range (since the late Miocene) was formed by the subduction of the Indian plate causing the obduction of an accretionary prism upon the Indian continental margin (Ni et al. 1989). The resulting mountain ranges consist of deep canyons, ridges, and high peaks, the latter reaching elevations of 1,989 m in Rakhine State, 3,109 m in Chin State, and 3,826 m in Sagaing Division. The vegetation types within the Indo-Burman Range includes lowland tropical rain forest along the Bay of Bengal, subtropical lowland forest, subtropical mountain forest and temperate mountain forest at higher elevations (Davis 1964). The formation of the Indo-Burman Range clearly impacted local climate, especially rainfall, and vegetation. With the progressive increase in topographic relief, occasioned by collision tectonics since late-Miocene, vicariant speciation, a consequence of the disruption of gene flow among the closely allied but increasingly fragmented populations of reptiles and amphibians, resulted in a high degree of local species endemism.

As noted above, relatively few collections have been made in the Indo-Burman Range. For instance, other than incidental collections, the only serious collecting forays were made by F.E.W. Venning, who collected in the Hakha area from 1908 to 1910 (Venning 1910a, 1910b), and Gerd Heinrich, who collected in the Mount Victoria area of the Chin Hills in 1938 (Shreve 1940). Thus, the work of the Myanmar Herpetological team, which will return to the Indo-Burman Range in 2003, can be expected to generate exciting new information about the diversity of amphibians and reptiles in this pivotal region of southeast Asia.

KEY TO THE SPECIES OF THE GENUS *CALOTES* OF MYANMAR

1. Two parallel rows of compressed spines above tympanum present *C. jerdoni*
Two parallel rows of compressed spines above tympanum absent 2
2. Head spines absent *C. kingdonwardi*
Head spines present 3
3. Fold in front of shoulder absent *C. versicolor*
Fold in front of shoulder present 4

- 4 Large postorbital spine present *C. emma*
 Large postorbital spine absent 5
5. 47–57 midbody scale rows, tail not swollen posterior to base in males *C. mystaceus*
 59–74 midbody scale rows, tail swollen posterior to base in males *C. chincollium*

MATERIAL EXAMINED

HOLOTYPE— CAS 220009 (σ), from 21°23'11.2" N, 93°58'15.9" E, 1174 m elevation, Min Dat Township, Min Dat District, Chin State, Myanmar, collected 20 March 2002 by Htun Win, Kyi Soe Lwin and Awan Khwi Shein.

PARATYPES (43 specimens, all from Chin State, Myanmar and, except as noted, collected by combinations of Htun Win, Thin Thin, Kyi Soe Lwin, Awan Khwi Shein and Hla Tun).— CAS 219971 (φ), 21°23'26.6" N, 94°03'31.2" E, Htin Chaun Village, Min Dat Township, Min Dat District, collected 18 March 2001; CAS 219972–219973 ($\sigma\sigma$), from 21°23'26.6" N, 94°03'31.2" E, Htin Chaun Village, Min Dat Township, Min Dat District, collected 18 March 2001; CAS 219974 (σ), CAS 219975 (φ), from 21°22'20.1" N, 93°58'34.6" E, 1482 m elevation, Baw Khue Plantation, Htin Chaun Village, Min Dat Township, Min Dat District, collected 18 March 2001; CAS 219976 (σ), from 21°22'52.7" N, 93°53'43.8" E, Baw Khue Plantation, Min Dat Township, Min Dat District, collected 19 March 2001; CAS 219977 (σ), CAS 219978 (φ), from 21°22'20.1" N, 93°58'34.6" E, 1482 m elevation, Baw Khue Plantation, Htin Chaun Village, Min Dat Township, Min Dat District, collected 19 March 2001; CAS 219990 (σ), from 21°24'08.2" N, 93°52'45.0" E, 1920 m elevation, Baw Khue Plantation, Min Dat Township, Min Dat District, collected 19 March 2001; CAS 219996 (σ), from 21°22'15.5" N, 93°59'13.6" E, 1418 m elevation, Min Dat Township, Min Dat District, collected 20 March 2001; CAS 219997 (σ), from 21°23'20.9" N, 93°52'29.0" E, 1940 m elevation, Baw Khue Plantation, Min Dat Township, Min Dat District, collected 19 March 2001; CAS 220012, USNM 547926 ($\sigma\sigma$), from 21°22'50.1" N, 93°58'20.6" E, 1297 m elevation, Min Dat Township, Min Dat District, collected 20 March 2001; CAS 220014 (φ), from 21°22'50.1" N, 93°58'20.6" E, 1297 m elevation, Min Dat Township, Min Dat District, collected 20 March 2001; CAS 220022 (φ), from 21°22'11.5" N, 93°46'01.7" E, 1732 m elevation, Min Dat Township, Min Dat District, collected 22 March 2001; CAS 220027–220028 ($\sigma\sigma$), from 21°22'18.3" N, 93°49'00.6" E, 1787 m elevation, Hee Laung Village, Min Dat Township, Min Dat District, collected 24 March 2001; CAS 220029 (σ), from 21°23'16.1" N, 93°58'14.9" E, 1138 m elevation, Min Dat Township, Min Dat District, collected 20 March 2001; CAS 220034 (σ), from 21°22'07.6" N, 93°49'04.0" E, 1624 m elevation, Hee Laung Village, Min Dat Township, Min Dat District, collected 25 March 2001; CAS 220035 (σ), from 21°21'33.7" N, 93°49'13.6" E, Hee Laung Village, Min Dat Township, Min Dat District, collected 25 March 2001; CAS 220039 (σ), from 21°20'13.3" N, 93°55'22.1" E, 1046 m elevation, Che stream, Min Dat Township, Min Dat District, collected 29 March 2001; CAS 220046 (σ), from 21°19'42.6" N, 93°55'25.2" E, Che stream, Min Dat Township, Min Dat District, collected 29 March 2001; CAS 220049 (σ), from 21°21'14.9" N, 93°56'08.3" E, Che stream, Min Dat Township, Min Dat District, collected 29 March 2001; CAS 220117 (σ), from 21°22'14.2" N, 93°48'14.1" E, Che stream, Min Dat Township, Min Dat District, collected 30 March 2001; CAS 220120 (φ), CAS 220121, USNM 547927 ($\sigma\sigma$), from 21°20'53.8" N, 93°59'56.3" E, 1112 m elevation, Che stream, Min Dat Township, Min Dat District, collected 31 March 2001; CAS 220125 (σ), from 21°21'02.3" N, 93°56'00.2" E, 783 m elevation, Che stream, Min Dat Township, Min Dat District, collected 2 April 2001; CAS 220577 (σ), from 21°11'44.3" N, 94°04'53.3" E, Kanpetlet Township, Min Dat

District, collected 25 February 2001; CAS 220578 (♀), from 21°11'23.0" N, 94°01'49.3" E, Kanpetlet Township, Min Dat District, collected 26 February 2001; CAS 220579 (♀), from 21°11'24.2" N, 94°04'11.2" E, Kanpetlet Township, Min Dat District, collected 27 February 2001; CAS 220580 (♂), from 21°13'19.7" N, 93°57'52.5" E, Kanpetlet Township, Min Dat District, collected 11 March 2001; CAS 220581 (♂), from 21°11'55.2" N, 94°03'57.8" E, Kanpetlet Township, Min Dat District, collected 28 February 2001; CAS 220582 (♂), from 21°11'53.5" N, 94°04'00.5" E, Kanpetlet Township, Min Dat District, collected 28 February 2001; CAS 220583 (♂), CAS 220584 (♀), from 21°11'37.1" N, 94°02'58.2" E; 1572 m elevation, Kanpetlet Township, Min Dat District, collected 12 March 2001; CAS 220587 (♀), from 21°23'25.4" N, 94°03'06.9" E, Htin Chaun Village, Min Dat Township, Min Dat District, collected 17 March 2001; CAS 222351 (♀), from 21°11'31.9" N, 94°03'00.8" E, Kanpetlet Township, Min Dat District, collected 26 February 2001; CAS 222354 (♂), from 21°11'53.3" N, 94°04'00.5" E, Kanpetlet Township, Min Dat District, collected 28 February 2001; CAS 222370 (♂), from 21°21'17.3" N, 93°56'11.0" E, 751 m elevation, Che stream, Min Dat Township, Min Dat District, collected 2 April 2001; MCZ R44727–44729 (♂♂s), from Mt. Victoria, Chin State, Myanmar, collected 31 March to 2 July 1938, by Gerd Heinrich.

ADDITIONAL MATERIAL EXAMINED

Calotes chincollium — CAS 222349, 21°11'27.5" N, 94°04'56.9" E, Kanpetlet Township, Min Dat District, Chin State, Myanmar; CAS 222350, 21°11'23.0" N, 94°01'49.3" E, Kanpetlet Township, Min Dat District, Chin State, Myanmar; CAS 222352–222353, 21°11'44.2" N, 94°04'47.5" E, Kanpetlet Township, Min Dat District, Chin State, Myanmar; CAS 222355–222356, 21°15'43.8" N, 93°59'20.3" E, 1734 m elevation, Thui Shwn Village, Kanpetlet Township, Min Dat District, Chin State, Myanmar; CAS 222357, 21°11'45.5" N, 94°03'48.2" E, 1372 m elevation, Kanpetlet Township, Min Dat District, Chin State, Myanmar; CAS 222358, 21°11'32.3" N, 94°05'11.2" E, Kanpetlet Township, Min Dat District, Chin State, Myanmar; CAS 222359–222360, 21°22'00.4" N, 94°00'40.2" E, Htin Chaun Village, Kanpetlet Township, Min Dat District, Chin State, Myanmar; CAS 222361, 21°22'20.1" N, 93°58'34.6" E, 1482 m elevation, Htin Chaun Village, Kanpetlet Township, Min Dat District, Chin State, Myanmar; CAS 222362, 21°23'26.6" N, 94°03'31.2" E, Htin Chaun Village, Kanpetlet Township, Min Dat District, Chin State, Myanmar; CAS 222363, 21°22'20.1" N, 93°58'34.6" E, Baw Khue Plantation, Min Dat Township, Min Dat District, Chin State, Myanmar; CAS 222364, 21°22'18.3" N, 93°49'00.6" E, 1787 m elevation, Hee Laung Village, Min Dat Township, Min Dat District, Chin State, Myanmar; CAS 222365–66, 21°20'13.3" N, 93°55'22.1" E, 1047 m elevation, Che stream, Min Dat Township, Min Dat District, Chin State, Myanmar; CAS 222367, 21°18'52.4" N, 93°54'48.7" E, 1308 m elevation, Che stream, Min Dat Township, Min Dat District, Chin State, Myanmar; CAS 222368, 21°22'14.2" N, 93°48'14.1" E, Che stream, Min Dat Township, Min Dat District, Chin State, Myanmar; CAS 222369, 21°21'14.9" N, 93°56'08.3" E, Che stream, Min Dat Township, Min Dat District, Chin State, Myanmar; CAS 222371, 21°21'13.1" N, 93°56'03.3" E, 738 m elevation, Che stream, Min Dat Township, Min Dat District, Chin State, Myanmar; MCZ 44730, Mt. Victoria, Chin State, Myanmar; CAS 215505–215507, 22°15'18.0" N, 94°16'46.5" E, Lesha Chaung camp, Alaungdaw Kathapa National Park, Sagaing Division, Myanmar.

Calotes emma — CAS 94323, Lawachera Forest, Srimangal, Bangladesh; CAS 172718, ca. 1200 m elevation, park headquarters complex, Doi Suthep National Park, Chiang Mai Province, Thailand; CAS 172764, ca 1500 m elevation, ca 3.5 km above upper ranger station, on trail to peak, Doi Inthanon National Park, Chiang Mai Province, Thailand; CAS 215260, 20°41'47.5" N, 96°30'17.5" E, Wat Phu Ye camp, Kalaw Township, Shan State, Myanmar; CAS 216395,

22°57'16.8" N, 96°14'26.5" E, Ondan Village, Shwe U Daung Wildlife Sanctuary, Moe Kok Township, Pyin Oo Lwin District, Mandalay Division, Myanmar; CAS 222213, 17°31'23.8" N, 97°03'00.9" E, near Kyauk Phyar Village, Kyaik-Hti-Yo Wildlife Sanctuary, Kyaik-Hti-Yo Township, Mon State, Myanmar.

Calotes jerdoni — CAS 94324, 11.6 km S of Pynursla, Assam, India; CAS 219992–219993, 21°23'01.5" N, 93°53'55.9" E, 1788 m elevation, Baw Khue Plantation, Min Dat Township, Min Dat District, Chin State, Myanmar; CAS 220020, 21°11'08.3" N, 93°45'33.8" E, 1938 m elevation, Min Dat Township, Min Dat District, Chin State, Myanmar; CAS 220026, 21°26'04.6" N, 93°49'29.6" E, 1663 m elevation, Min Dat Township, Min Dat District, Chin State, Myanmar; CAS 221514, 27°26'28.4" N, 97°55'07.5" E, Rabaw, Naung Mon Township, Putao District, Kachin State, Myanmar; CAS 221551, 27°17'23.8" N, 97°51'30.5" E, road between Ahtonga and Rabaw, Machanbaw Township, Putao District, Kachin State, Myanmar.

Calotes kingdonwardi — KIZ 730010 (holotype of *C. kingdonwardi bapoensis*), KIZ 730036, Bapo, Gongshan Xian, Yunnan Province, China.

Calotes mystaceus — CAS 208441, 21°38'36.3" N, 96°00'28.8" E, fields west of Kyauk Se, Shan Ywa Village, Kyauk Se Township, Mandalay Division, Myanmar; CAS 208446, 21°34'05.4" N, 96°09'43.7" E, fields and hills just east of Kyauk Se Village, Kyauk Se Township, Mandalay Division, Myanmar; CAS 213960, 20°57'14.4" N, 95°11'23.6" E, Popa Mountain Park, Kyauk Pan Tawn Township, Mandalay Division, Myanmar; CAS 214092, 20°52'43.7" N, 95°09'56.3" E, Popa Mountain Park, Kyauk Pan Tawn Township, Mandalay Division, Myanmar; CAS 214097, 20°53'01.8" N, 95°10'29.9" E, Popa Mountain Park, Kyauk Pan Tawn Township, Mandalay Division, Myanmar; CAS 214117, 20°58'06.7" N, 95°14'32.4" E, Popa Mountain Park, Kyauk Pan Tawn Township, Mandalay Division, Myanmar; CAS 214168, 21°07'21.3" N, 94°51'29.6" E, Nyaung Oo Township, Lawka Nanda Park, Mandalay Division, Myanmar; CAS 215321, 215323–215326, 20°46'07.3" N, 96°20'05.5" E, Forest Department office, Yin Mar Bin Village, Thazi Township, Mandalay Division, Myanmar; CAS 215930, 21°24'53.2" N, 95°46'55.0" E, Shout Taw Yoe camp, Minsontaung Wildlife Sanctuary, Na Htoe Gyi Township, Mandalay Division, Myanmar; CAS 215970, 21°24'09.8" N, 95°48'06.0" E, Shout Taw Yoe camp, Minsontaung Wildlife Sanctuary, Na Htoe Gyi Township, Mandalay Division, Myanmar; CAS 216014, 21°22'44.4" N, 95°48'05.8" E, Kat Lan Dam, Minsontaung Wildlife Sanctuary, Mandalay Division, Myanmar; CAS 216031, 21°24'43.4" N, 95°49'54.1" E, Htan Taw Village, Minsontaung Wildlife Sanctuary, Na Htoe Gyi Township, Mandalay Division, Myanmar; CAS 215766, 22°14'36.1" N, 94°38'59.1" E, Pwint Kyi camp, Alaungdaw Kathapa National Park, Sagaing Division, Myanmar; CAS 210705, 21°33'43.5" N, 95°12'43.9" E, near Pakokku, Magwe Division, Myanmar; CAS 215895, 21°35'47.5" N, 95°07'18.1" E, Yar Gyi Gone Village, Shin Ma Taung Reserve, Ye Sa Gyo Township, Pakokku District, Magwe Division, Myanmar; CAS 220574–220576, 21°14'45.5" N, 94°09'53.6" E, Forest Department, Saw Town, Saw Township, Gan Gaw District, Magwe Division, Myanmar; CAS 220016, 21°23'16.1" N, 93°58'14.9" E, 1138 m elevation, Min Dat Township, Min Dat District, Chin State, Myanmar; CAS 220586, 21°23'26.6" N, 94°03'31.2" E, Htin Chaun Village, Kanpetlet Township, Min Dat District, Chin State, Myanmar.

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